ABSTRACT

A system for digitally linearizing the nonlinear behaviour of RF high efficiency amplifiers employing baseband predistortion techniques is disclosed. The system provides additive or multiplicative predistortion of the digital quadrature (I/Q) input signal in order to minimize distortion at the output of the amplifier. The predistorter uses a discrete-time polynomial kernel to model the inverse transfer characteristic of the amplifier, providing separate and simultaneous compensation for nonlinear static distortion, linear dynamic distortion and nonlinear memory effects. Compensation for thermal memory effects is imbedded in the nonlinear dynamic compensation section of the predistorter and is implemented parametrically using an autoregressive dynamics tracking mechanism. A predistortion controller periodically monitors the output of the amplifier and compares it to the quadrature input signal to compute estimates of the residual output distortion of the amplifier. Output distortion estimates are used to adaptively compute the values of the parameters of the predistorter in response to changes in the amplifier's operating conditions (temperature drifts, changes in modulation input BW, variations in drive level, aging, etc). The predistortion controller performs spectral analyses of the distortion estimates to optimize the linearity of the amplifier in different frequency sub-bands. The predistortion parameter values computed by the predistortion controller are stored in non-volatile (NVRAM) memory and used as tap weights in the polynomial digital predistortion filter. The polynomial digital predistortion filter is preferably implemented in FPGA/ASIC technology to provide wide bandwidth on-line predistortion of the digital input signal. The digital predistortion system of the invention is designed to provide broadband linearization of highly nonlinear and highly efficient RF amplification circuits including, but not limited to, dynamic load modulation amplifiers.